

Claims

1 Claim 1 (original): A computer program product for sending Transmission Control Protocol
2 (TCP) messages through HyperText Transfer Protocol (HTTP) systems, the computer program
3 product embodied on one or more computer-readable media and comprising:

4 computer-readable program code means for establishing a send channel from a first
5 component on a client side of a network connection, through one or more HTTP-based systems,
6 to a second component on a remote side of the network connection;

7 computer-readable program code means for establishing a receive channel from the first
8 component, through the one or more HTTP-based systems, to the second component;

9 computer-readable program code means for establishing a first TCP connection from a
10 client on the client side to the first component;

11 computer-readable program code means for establishing a second TCP connection from
12 the second component to a target server on the remote side;

13 computer-readable program code means for transmitting client-initiated TCP requests
14 from the client to the target server on the send channel; and

15 computer-readable program code means for transmitting server-initiated TCP requests
16 from the target server to the client on the receive channel.

1 Claim 2 (original): The computer program product according to Claim 1, wherein the computer-
2 readable program code means for transmitting client-initiated TCP requests further comprises:

3 computer-readable program code means for receiving a client-initiated TCP request from
4 the client at the first component on the first TCP connection;

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5 computer-readable program code means for packaging the received client-initiated TCP
6 request in an HTTP POST request message;

7 computer-readable program code means for sending the HTTP POST request message to
8 the second component on the network connection;

9 computer-readable program code means for receiving the sent HTTP POST request
10 message at the second component;

11 computer-readable program code means for extracting the client-initiated TCP request
12 from the received HTTP POST request message; and

13 computer-readable program code means for forwarding the extracted client-initiated TCP
14 request to the target server on the second TCP connection.

1 Claim 3 (original): The computer program product according to Claim 2, wherein the computer-
2 readable program code means for transmitting client-initiated TCP requests further comprises
3 computer-readable program code means for acknowledging the HTTP POST request by sending
4 an HTTP POST response from the second component to the first component on the network
5 connection.

1 Claim 4 (original): The computer program product according to Claim 3, wherein the computer-
2 readable program code means for establishing the send channel operates in response to the
3 computer-readable program code means for receiving the client-initiated TCP request, and
4 wherein the computer-readable program code means for transmitting client-initiated TCP requests
5 further comprises:

6 computer-readable program code means for receiving the HTTP POST response at the
7 first component; and

8 computer-readable program code means for closing the send channel, responsive to
9 operation of the computer-readable program code means for receiving the HTTP POST response.

1 Claim 5 (original): The computer program product according to Claim 1, wherein the computer-
2 readable program code means for transmitting server-initiated TCP requests further comprises:

3 computer-readable program code means for sending an HTTP GET request message from
4 the first component to the second component on the network connection;

5 computer-readable program code means for receiving the sent HTTP GET request
6 message at the second component;

7 computer-readable program code means for receiving a server-initiated TCP request from
8 the target server at the second component on the second TCP connection;

9 computer-readable program code means for packaging the received server-initiated TCP
10 request in an HTTP GET response message which acknowledges the received HTTP GET
11 request message;

12 computer-readable program code means for sending the HTTP GET response message
13 from the second component to the first component on the network connection;

14 computer-readable program code means for receiving the sent HTTP GET response
15 message at the first component;

16 computer-readable program code means for extracting the server-initiated TCP request
17 from the received HTTP GET response message; and

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18 computer-readable program code means for forwarding the extracted server-initiated TCP
19 request to the client on the first TCP connection.

1 Claim 6 (original): The computer program product according to Claim 5, wherein the computer-
2 readable program code means for transmitting server-initiated TCP requests further comprises:
3 computer-readable program code means for performing a read operation on the second
4 TCP connection, responsive to operation of the computer-readable program code means for
5 receiving the sent HTTP GET request message and prior to operation of the computer-readable
6 program code means for receiving the server-initiated TCP request; and
7 computer-readable program code means for using the received server-initiated TCP
8 request as a result of the read operation, thereby triggering operation of the computer-readable
9 program code means for packaging the received server-initiated TCP request in the HTTP GET
10 response message.

1 Claim 7 (original): The computer program product according to Claim 5, wherein the computer-
2 readable program code means for transmitting server-initiated TCP requests further comprises
3 computer-readable program code means for preparing to receive another server-initiated TCP
4 request by triggering operation of the computer-readable program code means for sending the
5 HTTP GET request message from the first component to the second component, responsive to
6 operation of the computer-readable program code means for receiving the sent HTTP GET
7 response message at the first component.

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1 Claim 8 (original): The computer program product according to Claim 2, wherein a Multi-
2 Purpose Internet Mail Extensions (MIME) type of the HTTP POST request message is set to
3 "binary/tcp".

1 Claim 9 (original): The computer program product according to Claim 5, wherein a Multi-
2 Purpose Internet Mail Extensions (MIME) type of the HTTP GET request message is set to
3 "binary/tcp".

1 Claim 10 (original): A system for sending Transmission Control Protocol (TCP) messages
2 through HyperText Transfer Protocol (HTTP) systems, comprising:

3 means for establishing a send channel from a first component on a client side of a network
4 connection, through one or more HTTP-based systems, to a second component on a remote side
5 of the network connection;

6 means for establishing a receive channel from the first component, through the one or
7 more HTTP-based systems, to the second component;

8 means for establishing a first TCP connection from a client on the client side to the first
9 component;

10 means for establishing a second TCP connection from the second component to a target
11 server on the remote side;

12 means for transmitting client-initiated TCP requests from the client to the target server on
13 the send channel; and

14 means for transmitting server-initiated TCP requests from the target server to the client on

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15 the receive channel.

1 Claim 11 (original): The system according to Claim 10, wherein the means for transmitting client-
2 initiated TCP requests further comprises:

3 means for receiving a client-initiated TCP request from the client at the first component on
4 the first TCP connection;

5 means for packaging the received client-initiated TCP request in an HTTP POST request
6 message;

7 means for sending the HTTP POST request message to the second component on the
8 network connection;

9 means for receiving the sent HTTP POST request message at the second component;

10 means for extracting the client-initiated TCP request from the received HTTP POST
11 request message; and

12 means for forwarding the extracted client-initiated TCP request to the target server on the
13 second TCP connection.

1 Claim 12 (original): The system according to Claim 11, wherein the means for transmitting client-
2 initiated TCP requests further comprises means for acknowledging the HTTP POST request by
3 sending an HTTP POST response from the second component to the first component on the
4 network connection.

1 Claim 13 (original): The system according to Claim 12, wherein the means for establishing the

2 send channel operates in response to the means for receiving the client-initiated TCP request, and
3 wherein the means for transmitting client-initiated TCP requests further comprises:
4 means for receiving the HTTP POST response at the first component; and
5 means for closing the send channel, responsive to operation of the means for receiving the
6 HTTP POST response.

1 Claim 14 (original): The system according to Claim 10, wherein the means for transmitting
2 server-initiated TCP requests further comprises:
3 means for sending an HTTP GET request message from the first component to the second
4 component on the network connection;
5 means for receiving the sent HTTP GET request message at the second component;
6 means for receiving a server-initiated TCP request from the target server at the second
7 component on the second TCP connection;
8 means for packaging the received server-initiated TCP request in an HTTP GET response
9 message which acknowledges the received HTTP GET request message;
10 means for sending the HTTP GET response message from the second component to the
11 first component on the network connection;
12 means for receiving the sent HTTP GET response message at the first component;
13 means for extracting the server-initiated TCP request from the received HTTP GET
14 response message; and
15 means for forwarding the extracted server-initiated TCP request to the client on the first
16 TCP connection.

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1 Claim 15 (original): The system according to Claim 14, wherein the means for transmitting
2 server-initiated TCP requests further comprises:

3 means for performing a read operation on the second TCP connection, responsive to
4 operation of the means for receiving the sent HTTP GET request message and prior to operation
5 of the means for receiving the server-initiated TCP request; and

6 means for using the received server-initiated TCP request as a result of the read operation,
7 thereby triggering operation of the means for packaging the received server-initiated TCP request
8 in the HTTP GET response message.

1 Claim 16 (original): The system according to Claim 14, wherein the means for transmitting
2 server-initiated TCP requests further comprises means for preparing to receive another server-
3 initiated TCP request by triggering operation of the means for sending the HTTP GET request
4 message from the first component to the second component, responsive to operation of the means
5 for receiving the sent HTTP GET response message at the first component.

1 Claim 17 (original): The system according to Claim 11, wherein a Multi-Purpose Internet Mail
2 Extensions (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 Claim 18 (original): The system according to Claim 14, wherein a Multi-Purpose Internet Mail
2 Extensions (MIME) type of the HTTP GET request message is set to "binary/tcp".

1 Claim 19 (original): A method for sending Transmission Control Protocol (TCP) messages
2 through HyperText Transfer Protocol (HTTP) systems, comprising the steps of:
3 establishing a send channel from a first component on a client side of a network
4 connection, through one or more HTTP-based systems, to a second component on a remote side
5 of the network connection;
6 establishing a receive channel from the first component, through the one or more HTTP-
7 based systems, to the second component;
8 establishing a first TCP connection from a client on the client side to the first component;
9 establishing a second TCP connection from the second component to a target server on
10 the remote side;
11 transmitting client-initiated TCP requests from the client to the target server on the send
12 channel; and
13 transmitting server-initiated TCP requests from the target server to the client on the
14 receive channel.

1 Claim 20 (original): The method according to Claim 19, wherein the step of transmitting client-
2 initiated TCP requests further comprises the steps of:
3 receiving a client-initiated TCP request from the client at the first component on the first
4 TCP connection;
5 packaging the received client-initiated TCP request in an HTTP POST request message;
6 sending the HTTP POST request message to the second component on the network
7 connection;

8 receiving the sent HTTP POST request message at the second component;
9 extracting the client-initiated TCP request from the received HTTP POST request
10 message; and
11 forwarding the extracted client-initiated TCP request to the target server on the second
12 TCP connection.

1 Claim 21 (original): The method according to Claim 20, wherein the step of transmitting client-
2 initiated TCP requests further comprises the step of acknowledging the HTTP POST request by
3 sending an HTTP POST response from the second component to the first component on the
4 network connection.

1 Claim 22 (original): The method according to Claim 21, wherein the step of establishing the send
2 channel operates in response to the step of receiving the client-initiated TCP request, and wherein
3 the step of transmitting client-initiated TCP requests further comprises the steps of:
4 receiving the HTTP POST response at the first component; and
5 closing the send channel, responsive to receiving the HTTP POST response.

1 Claim 23 (original): The method according to Claim 19, wherein the step of transmitting server-
2 initiated TCP requests further comprises the steps of:
3 sending an HTTP GET request message from the first component to the second
4 component on the network connection;
5 receiving the sent HTTP GET request message at the second component;

6 receiving a server-initiated TCP request from the target server at the second component
7 on the second TCP connection;

8 packaging the received server-initiated TCP request in an HTTP GET response message
9 which acknowledges the received HTTP GET request message;

10 sending the HTTP GET response message from the second component to the first
11 component on the network connection;

12 receiving the sent HTTP GET response message at the first component;

13 extracting the server-initiated TCP request from the received HTTP GET response
14 message; and

15 forwarding the extracted server-initiated TCP request to the client on the first TCP
16 connection.

1 Claim 24 (original): The method according to Claim 23, wherein the step of transmitting server-
2 initiated TCP requests further comprises the steps of:

3 performing a read operation on the second TCP connection, responsive to receiving the
4 sent HTTP GET request message and prior to receiving the server-initiated TCP request; and

5 using the received server-initiated TCP request as a result of the read operation, thereby
6 triggering the step of packaging the received server-initiated TCP request in the HTTP GET
7 response message.

1 Claim 25 (original): The method according to Claim 23, wherein the step of transmitting server-
2 initiated TCP requests further comprises the step of preparing to receive another server-initiated

3 TCP request by triggering the step of sending the HTTP GET request message from the first
4 component to the second component, responsive to receiving the sent HTTP GET response
5 message at the first component.

1 Claim 26 (original): The method according to Claim 20, wherein a Multi-Purpose Internet Mail
2 Extensions (MIME) type of the HTTP POST request message is set to "binary/tcp".

1 Claim 27 (original): The method according to Claim 23, wherein a Multi-Purpose Internet Mail
2 Extensions (MIME) type of the HTTP GET request message is set to "binary/tcp".

1 Claim 28 (original): A method for transporting bi-directional protocol traffic through uni-
2 directional protocol systems, comprising the steps of:
3 establishing a send channel from a first component on a client side of a network
4 connection, through one or more uni-directional protocol-based systems, to a second component
5 on a remote side of the network connection;
6 establishing a receive channel from the first component, through the one or more uni-
7 directional protocol-based systems, to the second component;
8 establishing a first bi-directional protocol connection from a client on the client side to the
9 first component;
10 establishing a second bi-directional protocol connection from the second component to a
11 target server on the remote side;
12 transmitting client-initiated bi-directional protocol requests from the client to the target

13 server on the send channel; and
14 transmitting server-initiated bi-directional protocol requests from the target server to the
15 client on the receive channel.

1 Claim 29 (original): The method according to Claim 28, wherein the step of transmitting client-
2 initiated bi-directional protocol requests further comprises the steps of:
3 receiving a client-initiated bi-directional protocol request from the client at the first
4 component on the first bi-directional protocol connection;
5 packaging the received client-initiated bi-directional protocol request in a uni-directional
6 protocol write request message;
7 sending the uni-directional protocol write request message to the second component on
8 the network connection;
9 receiving the sent uni-directional protocol write request message at the second
10 component;
11 extracting the client-initiated bi-directional protocol request from the received uni-
12 directional protocol write request message; and
13 forwarding the extracted client-initiated bi-directional protocol request to the target server
14 on the second bi-directional protocol connection.

1 Claim 30 (original): The method according to Claim 28, wherein the step of transmitting server-
2 initiated bi-directional protocol requests further comprises the steps of:
3 sending a uni-directional protocol read request message from the first component to the

4 second component on the network connection;
5 receiving the sent uni-directional protocol read request message at the second component;
6 receiving a server-initiated bi-directional protocol request from the target server at the
7 second component on the second bi-directional protocol connection;
8 packaging the received server-initiated bi-directional protocol request in a uni-directional
9 protocol read response message which acknowledges the received uni-directional protocol read
10 request message;
11 sending the uni-directional protocol read response message from the second component to
12 the first component on the network connection;
13 receiving the sent uni-directional protocol read response message at the first component;
14 extracting the server-initiated bi-directional protocol request from the received uni-
15 directional protocol read response message; and
16 forwarding the extracted server-initiated bi-directional protocol request to the client on the
17 first bi-directional protocol connection.